Analysis of Cauda Equina MRI referrals between 2017 to 2020 – Scan requests, findings and positive and negative predictive factors

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95

OBJECTIVES

Primary aim: Analyse referral trends from years between 2017 to 2020, assessing variations in volume in requests, key findings, and predictive factors of patients

- Evaluate MRI scan outcomes – positive and negative predictive factors
- Data is drawn from a defined cohort of referrals in the Cardiff and Vale Health Board to provide representative regional practice
- Highlight opportunities to refine referral pathways to ensure appropriate imaging etiquette, the correct patients were identified as query CES and the proportion of patients who had CES

INTRODUCTION

Cauda equina syndrome (CES) is a serious medical emergency resulting from the compression of a series of nerves known as the cauda equina (1). Symptoms of the syndrome can vary from patient to patient however symptoms include back pain, sciatica – usually bilateral in nature – perianal numbness, reduced anal tone, saddle anaesthesia and sexual dysfunction (2).

CES requires urgent medical attention as compression for too long can lead to permanent neurological deficits. Due to the vague and nonspecific symptoms, CES can be missed or overly tested for via MRI (3). Furthermore, between these years, there was a lack of cohesive definitions for CES and their symptoms; what does perianal numbness mean to the physician or to the patient reporting the symptom, for example (4).

This project investigates factors underlying the rise in MRI referrals and aims to identify collections of symptoms that negatively predict CES. This may support more effective triage, improve diagnostic efficiency while reducing unnecessary imaging and healthcare burden.

METHOD

A retrospective study was conducted at the Emergency Division of the University Hospital of Wales (UHW), including referrals from Orthopaedics and Trauma, Neurosurgery, and Emergency Medicine. All urgent MRI scans performed for suspected cauda equina syndrome (CES) were retrieved from radiology records. Reports containing the indication "query CES" or equivalent wording were included, and patients were grouped by year of presentation to enable temporal comparison of referral patterns.

A custom macro, developed using an AI assistant, was used to label MRI reports indicating suspected CES. No patient-identifiable information was used or accessible to the AI at any stage. Despite automated labelling, all MRI reports were subsequently reviewed and analysed manually.

Clinical data were extracted and coded for the following parameters: presence or absence of discogenic CES; whether the patient underwent subsequent spinal surgery regardless of CES status; and documented presenting symptoms. Symptoms assessed included:

- ***Urinary and faecal dysfunction***
- ***Saddle anaesthesia***
- ***Perianal numbness***
- ***Anal tone abnormalities***
- ***Sexual dysfunction***
- ***Back pain***
- ***Sciatica and radicular pain (bilateral or unilateral; side specific***
- ***Weakness (bilateral or unilateral; side specific)***
- ***Reduced power***
- ***Sensory changes***
- ***Paresthesia***
- ***Reflex changes***
- ***Gait disturbances***
- ***Presence or absence of CSF on MRI***

Exclusion criteria comprised MRI referrals not stating "query CES" or equivalent wording, CES not discogenic in origin, vague or absent clinical documentation, and cases outside the predefined study timeframe.

Descriptive statistics summarised patient characteristics, symptom prevalence, and referral trends. Comparative analyses between patients with and without confirmed CES were performed to identify negative predictive factors. Statistical significance was set at $p < 0.05$.

Ethical approval was obtained prior to data collection. All data were anonymised and handled in accordance with relevant data protection regulations.

RESULTS

A total of 513 patients underwent MRI for suspected CES, of whom 31 (6.0%) had confirmed CES. Sacral red-flag symptoms (urinary and bowel dysfunction, saddle anaesthesia, perianal changes, anal tone abnormality, sexual dysfunction) were present in 478 patients (93%), while 35 patients (6.8%) had no documented sacral red flags. No individual symptom significantly distinguished patients with confirmed CES from those without.

The presence of any sacral red-flag symptom was associated with lower odds of confirmed CES (OR 0.36, 95% CI 0.13–1.00), reflecting the high prevalence of these symptoms in the non-CES population. The mean number of sacral red-flag symptoms was similar between groups (CES 1.69 ± 1.09 vs non-CES 1.60 ± 0.86).

Symptom clusters, including bladder or bowel dysfunction (OR 0.66, 95% CI 0.32–1.40), bilateral neurological symptoms (OR 1.72, 95% CI 0.83–3.53), objective neurological deficits (OR 1.32, 95% CI 0.65–2.71), ≥2 sacral red-flag symptoms (OR 1.28, 95% CI 0.62–2.62), and combined bilateral plus sacral signs (OR 1.39, 95% CI 0.68–2.85), were not significantly associated with confirmed CES.

The ratio of scans to subsequent operations was 14.3%.

Overall, individual symptoms and symptom clusters demonstrated poor specificity for confirmed CES in this scanned population.

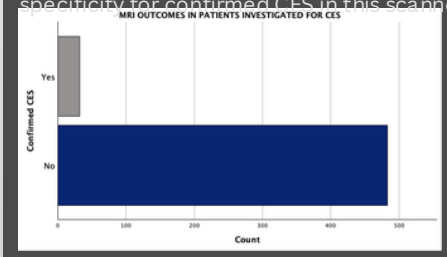

Figure 1 : MRI outcomes in patients investigated for suspected CES

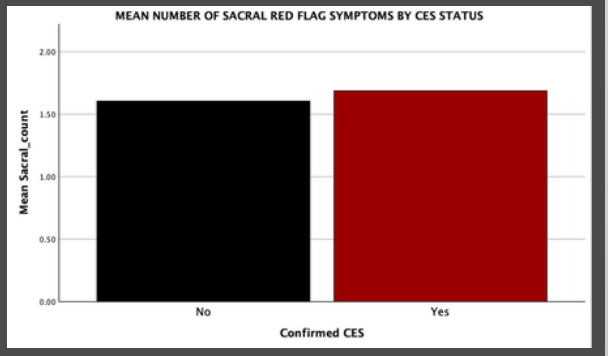

Figure 2 : Prevalence of sacral reg flag symptoms in the scanned cohort - CES confirmed and CES absent

CONCLUSION

This service evaluation concluded that individual symptoms, such as *only* urinary dysfunction, did not significantly distinguish patients with confirmed CES than without. Similarly, combinations of symptoms - bilateral symptoms, neurological deficits, sacral red flags - were not significantly associated with confirmed CES. Sacral red flags were highly prevalent in the scanned patients. This suggests that commonly cited red flag symptoms were sensitive in prompting investigation but lack specificity in true CES. The results indicate that symptom-based assessment, especially those that are subjective, have limited discrimination value for diagnosing CES by MRI. Ongoing data collection is expected to increase the number of confirmed cases and improve statistical power, allowing more robust evaluation of potential predictors and service performance over time

References

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